

Chapter 2 Project Alternatives

2.1 Alternative Development Process

A number of local, regional, state, and federal agencies participated in the development of alternatives for the proposed project. Caltrans held three public scoping meetings in 1991 to obtain input from the public, and additional meetings to obtain input from interested organizations and individuals. Twenty-three alternatives emerged from these meetings for consideration:

- fourteen build alternatives involving four basic interchange designs and their variations
- two build alternatives involving bypass routes around the interchange
- two interchange build alternatives in combination with lowering of profile or tunneling
- Transportation Systems Management (TSM)
- two HOV alternatives
- transit alternative
- a no build alternative

Caltrans and the Project Development Team (PDT) for the proposed project evaluated the alternatives on their ability to meet the purpose and need for the project (operational feasibility), environmental impacts, and cost. Caltrans and the PDT did not evaluate each of the twenty-three alternatives to the same level of detail. If an alternative was operationally unfeasible, less effort was expended on assessing environmental impacts and estimating costs.

Caltrans and the PDT eventually rejected twenty of the alternatives and carried two build alternatives (Alternatives 2C Variation and 2D Variation) and the No Build Alternative forward for detailed environmental analysis in the Draft Environmental Impact Statement/Environmental Impact Report (DEIS/R).

In 1997, Caltrans and the PDT added a third build alternative, Alternative H, to the proposed project since Alternatives 2C and 2D Variations were poorly received by the public at the Public Hearing and in the comment period for the DEIS/R.

2.2 Project Alternatives

2.2.1 The “No Build” Alternative

The existing interchange is a full, four-quadrant, cloverleaf-type interchange (Figure 2.2-1).^{*} Each of the four freeway-to-freeway loop connectors consists of one lane only. Collector-distributor facilities along I-880 southbound and I-880 northbound join a pair of the loop connectors exiting and entering I-880 from Route 92. The two freeway-to-freeway loop connectors from Route 92 to I-880 are metered. I-880 currently has ten lanes (six mixed flow, two HOV, and two auxiliary) north of Route 92, and eight lanes (six mixed flow and two HOV) south of Route 92. Route 92 now has six lanes from the Toll Plaza to I-880 with the completion of the San Mateo-Hayward Bridge Widening Project, and four lanes from I-880 to the terminus of Route 92 at the intersection of Jackson Street/Santa Clara Street. Under this alternative, the interchange remains unchanged except for minor improvements as needed within the right-of-way (e.g., landscaping, resurfacing) and routine maintenance work.

2.2.2 Alternative 2C Variation

Alternative 2C Variation (Figure 2.2-2) reconstructs the Route 92 eastbound to I-880 northbound and the Route 92 westbound to I-880 southbound loop connectors into direct, flyover connectors. Alternative 2C Variation also reconstructs Route 92 into separate westbound and eastbound structures on two different levels over I-880. The highest level is 10.02 m (32.88 feet) above the height of the existing Route 92 overcrossing of I-880 (Route 92/I-880 separation structure). The project adds a second lane to the I-880 southbound to Route 92 westbound diagonal connector. Other features include: sound walls and retaining walls; auxiliary lanes on I-880 southbound between Route 92 and the Tennyson Interchange; a reconstructed Cheney-Eldridge Pedestrian Overcrossing (POC); the accommodation of HOV bypass lanes, California Highway Patrol (CHP) enforcement areas, and ramp metering equipment on the direct, flyover connectors; and improvements to the Jackson Street- and Santa Clara Street intersection. To further reduce weaving and merging conflicts, the I-880 northbound off-ramp to West Winton Avenue is braided beneath the Route 92 eastbound to I-880 northbound connector. The braiding of the I-880 northbound off-ramp with the Route 92 eastbound to I-880 northbound connector prevents traffic from the connector from exiting at West Winton Avenue. Alternative 2C Variation acquires right-of-way in the northeast quadrant of the I-880/Route 92

^{*} Figures are located in Chapter 12

interchange. Partial acquisitions, temporary construction easements, and permanent easements are also needed in various locations. Alternative 2C Variation shifts I-880 between the Eden Greenway and the Cheney-Eldridge POC eastward up to 5.5 m (18 feet) to avoid additional right-of-way impacts. The total (design, right-of-way, construction, and contingency) estimated cost, in 2002 dollars, for Alternative 2C Variation is \$154.4 million.

2.2.3 Alternative 2D Variation

Alternative 2D Variation includes the same elements as Alternative 2C Variation, plus an auxiliary lane on I-880 southbound between the Winton Avenue Interchange and Route 92. The right-of-way impacts of Alternative 2D Variation are in the northwest quadrant of the I-880/Route 92 interchange rather than the northeast quadrant as in Alternative 2C. Partial acquisitions, temporary construction easements, and permanent easements are also needed in various locations. To avoid further right-of-way impacts, Alternative 2D Variation shifts I-880 westward a length of 1067 m (3500 feet) from a point 91 m (300 feet) north of Route 92. The total estimated cost for Alternative 2D Variation is \$151.6 million (2002 dollars). The schematic for Alternative 2C Variation, Figure 2.2-1, also depicts Alternative 2D.

2.2.4 Alternative H—The Preferred Alternative

As with Alternatives 2C and 2D Variations, Alternative H (see Figure 2.2-3 and Figure 2.2-4): reconstructs the Route 92 eastbound to I-880 northbound and the Route 92 westbound to I-880 southbound loop connectors into direct, flyover connectors (Figures 2.2-5 and 2.2-6); adds a second lane to the I-880 southbound to Route 92 westbound diagonal connector; constructs sound walls and retaining walls; provides auxiliary lanes on I-880 between Route 92 and the Tennyson Road Interchange (Figure 2.2-7) and auxiliary lanes on I-880 between the Winton Avenue Interchange and the I-880/Route 92 interchange (Figure 2.2-8); reconstructs the Cheney-Eldridge Pedestrian Overcrossing (Figure 2.2-9); provides CHP enforcement areas and ramp metering equipment on the direct, flyover connectors; and improves the intersections of Jackson and Santa Clara Streets (Figure 2.2-10) and Hesperian Boulevard/Route 92 on- and off-ramps.

Alternative H differs from Alternatives 2C and 2D Variations in that: Route 92 westbound and eastbound remain together as a two level overcrossing that is 5.26 m (17.26 feet) higher than the existing Route 92/I-880 separation structure (Figure 2.2-11); the Calaroga Avenue Overcrossing is lengthened (Figure 2.2-12); and the Route 92 westbound off-ramp at the Hesperian Boulevard interchange is reconfigured (Figure 2.2-13). The Mount Eden Overhead, a structure (Figure 2.2-14) over a railroad corridor to the west of the Route 92/Industrial Boulevard interchange, is widened to accommodate a fourth Route 92 eastbound lane. Also, the Route 92 eastbound to I-880 northbound direct connector is at the end of a collector-distributor that separates from Route 92 eastbound just west of Hesperian Boulevard. The collector-distributor begins with two mixed-flow lanes, then adds a third lane from the Hesperian Boulevard on-ramp. The right-most lane exits to I-880 southbound. The collector-distributor adds a HOV lane at the I-880/Route 92 interchange, and provides a slip off-ramp to the Jackson Street/Santa Clara Street intersection. The collector-distributor then becomes the Route 92 eastbound to I-880 northbound direct, flyover connector.

The Route 92 eastbound to I-880 northbound direct, flyover connector consists of one HOV lane and two mixed flow lanes. Just past the metering lights, the HOV lane merges with the #4 lane (counting from the median) on I-880 northbound, while the two mixed-flow lanes merge and enter I-880 northbound as the #5 lane. Restriping for a third mixed-flow lane at the metering lights would occur when warranted by future traffic conditions.

Right of way acquisitions for Alternative H are in the southwest quadrant of the I-880/Route 92 interchange. Partial acquisitions, temporary construction easements, and permanent easements are also needed in various locations. The total cost for Alternative H is \$134 million (\$9 million for right-of-way, \$98 million for construction, \$27 million for design and contingencies) in 2002 dollars.

2.3 Alternatives Considered and Withdrawn

Section 1502.14 of the Council on Environmental Quality (CEQ) Regulations for implementing the procedural provisions of the National Environmental Policy Act (NEPA) "requires the EIS (*Environmental Impact Statement*) to examine all reasonable alternatives to the proposal. In determining the scope of alternatives to be considered, the emphasis is on what is 'reasonable' ... Reasonable alternatives include those that are practical and feasible from the technical and economic

standpoint and using common sense, rather than simply desirable from the standpoint of the applicant."

Section 15126d of the State of California Environmental Quality Act (CEQA) Guidelines requires that governmental agencies consider reasonable alternatives that could feasibly obtain the basic objective of the project. The comparative merits of each alternative must be evaluated. The discussion must focus on alternatives capable of either eliminating adverse environmental effects or reducing them to a level of insignificance, even if such alternatives are more costly or, to some degree, impede the project's objectives. The analysis also needs to quantify the extent to which an alternative increases or decreases impacts. The range of alternatives required in an Environmental Impact Report (EIR) is governed by "rule of reason" that requires the EIR to set forth only those alternatives necessary to permit a reasoned choice. An EIR need not consider an alternative whose effect cannot be reasonably ascertained and whose implementation is remote and speculative.

During the various phases of preliminary design and environmental studies for this project, Caltrans and the PDT considered and withdrew twenty alternatives from consideration. The reasons these alternatives were withdrawn were their failure to meet the purpose and need for the project—satisfactory operations; acceptable environmental consequences and right-of-way impacts; and/or funding programmed for the proposed project. These alternatives were considered to be unreasonable and/or unfeasible. The alternatives withdrawn from further consideration are described in the next section. Table 2.2-1 summarizes the main features of the withdrawn alternatives and the specific reasons why these were dropped from further evaluation.

Alternative 1A

This alternative involves an interchange with a single loop ramp in the southwest quadrant (Figure 2.3-1). All traffic movements (eight in all) are achieved via two-lane direct connectors. The single loop in the southwest quadrant provides the I-880 southbound to Jackson Street movement.

A collector-distributor road is included between Route 92 and West Winton Avenue (northeast quadrant) to eliminate weaving conflicts on I-880 northbound between traffic from the direct connector entrance and traffic exiting to West Winton Avenue. An off-ramp from the direct connector to the collector-distributor road enables traffic

Table 2.2-1 Summary of Reasons For Rejecting Alternatives					
Alternative	REASON(S) FOR REJECTION				
	Does Not Meet Purpose & Need for Project	Environmental Impacts		Operationally Unfeasible	High Cost
		Large Number of Residential Displacements /Business/ Wetland Imp.	High Retaining/ Sound Walls		
1A		■			■
1B	■	■			
2A	■			■	
2B	■			■	
2C (without Winton Connection)			■		
2C (with Winton Connection)		■			
2D			■		
3A	■			■	
3B	■			■	
4A	■	■			■
4B	■	■			
4BX	■	■			
Lowering of Profile					■
Tunnel	■	■			■
Three-Loop	■				
2H	■			■	
2L	■				■
TSM	■				
HOV Lane		■			■
HOV Only	■				
Transit	■				■

exiting Route 92 eastbound to directly access West Winton Avenue. The Route 92 westbound to I-880 northbound on-ramp enters this same collector-distributor road before entering I-880 northbound downstream from the I-880/Winton Avenue Interchange. This alternative also involves reconstruction of the southern half of the Hesperian Boulevard Interchange.

This alternative improves all major traffic movements. However, of all the alternatives under consideration, this alternative results in the highest number of residential displacements (approximately 300 residences) as well as impacts to Eden Parkway. This alternative was dropped from further evaluation because of the high number of displacements, and construction costs (\$204 to \$217 million in 2002 dollars) exceeding available funding.

Alternative 1B

This interchange design consists of a three-loop interchange (Figure 2.3-2), retaining the existing loop connectors in the northeastern, southeastern, and northwestern quadrants. The main geometric features of this interchange include: a direct connector for Route 92 eastbound to I-880 northbound movement; a collector-distributor road between Route 92 and West Winton Avenue to eliminate weaving conflicts on I-880 northbound; the widening of the I-880 southbound to Route 92 westbound connector to two lanes; and the reconstruction of the southern half of the Hesperian Boulevard Interchange. The direct connector is elevated to a third level, approximately 7.6 m (25 feet) above Route 92. As with Alternative 1A, traffic from the Route 92/Jackson Street westbound to I-880 northbound on-ramp enters the collector-distributor road, and merges with I-880 northbound downstream of the I-880/Winton Avenue interchange.

Alternative 1B represents a first phase toward the development of Alternative 1A (full interchange replacement). This alternative offers many benefits such as improved movement on interchange sections with the highest existing and projected volumes, and compatibility with future improvements. The construction cost for this alternative is estimated to be \$96 to \$108 million (2002 dollars). Two primary factors resulted in dropping this design from further consideration. First, the alternative requires 150 to 170 residences. Second, the alternative represents an interim project towards development of Alternative 1A and does not improve all major traffic movements or provide the capacity needed on all ramps. Future improvements are still needed.

Alternative 2A

This alternative features a two-loop interchange, maintaining the loop connectors in the northeastern and southwestern quadrants (Figure 2.3-3). The eastbound and westbound alignments for Route 92 separate with the eastbound alignment elevated to the third level. The Route 92 eastbound to I-880 northbound movement is on a direct, flyover connector that exits Route 92 from the left lane and enters I-880 northbound in the left lane. The second direct flyover connector, for the Route 92 westbound to I-880 southbound movement, also features a left exit and a left entrance. Lastly, Alternative 2A adds an auxiliary lane on I-880 southbound between Route 92 and Tennyson Road. The construction costs are \$82 to \$94 million (2002 dollars).

Analysis of this interchange design indicates that while it improves the movements with the highest existing and projected volumes, this design was operationally unfeasible. First, the single lane entrance of the Route 92 eastbound to I-880 northbound direct flyover connector fails to relieve existing and projected peak hour traffic on Route 92 eastbound. Second, left entrances from connectors to I-880 reduce capacity on I-880 upstream and downstream. This alternative was eliminated because of these operational and safety deficiencies.

Alternative 2B

This interchange design is similar to Alternative 2A in all respects except that the direct connector for the Route 92 westbound to I-880 southbound involves a left exit and a right entrance (Figure 2.3-4). The construction costs are estimated to be \$82 to \$94 million (2002 dollars). This design was dropped from further consideration because the proposed modifications were similar to those proposed under Alternative 2A and are operationally infeasible.

Alternative 2C (without Winton Connection)

This interchange design is identical to Alternative 2C Variation in all respects except that it does not include the two separate freeway entrances onto I-880 northbound and southbound from Route 92 (Figure 2.3-5). It merges Route 92 eastbound and westbound connectors together to form a single entrance onto I-880, as a consequence of which relatively higher retaining and sound walls are needed in both the northeastern and the southwestern quadrants of the interchange.

This design was dropped from further consideration because, relative to Alternative 2C Variation, it results in greater visual impacts in the two quadrants noted above. All other impacts are identical to Alternative 2C Variation. As a consequence of the higher retaining/sound walls, this design also costs slightly more than Alternative 2C Variation.

Alternative 2C (with Winton Connection)

All geometric features for this alternative are the same as for Alternative 2C except that an off-ramp from the Route 92 eastbound to I-880 northbound connector and to a collector-distributor road to the Winton Avenue off-ramp are constructed to facilitate the West Winton Avenue exit movement. The Route 92 westbound to I-880 northbound movement is via the collector-distributor road to the I-880/Winton Avenue interchange, then the West Winton Avenue on-ramp to I-880.

Identical to Alternative 2C in all respects except for the added connector to Winton Avenue collector-distributor road, this alternative was rejected due to the high right-of-way requirements. The alternative displaces 80 to 100 residences, and has high construction costs of \$108 to \$121 million (2002 dollars). This alternative was rejected because it would cause additional impacts without providing greater benefits.

Alternative 2D

This interchange design is identical to Alternative 2D Variation in all respects except that it does not include the two separate freeway entrances onto I-880 northbound and southbound (Figure 2.3-6). As with Alternative 2C, a single entrance onto I-880 is included in both directions in this design, which results in the need for relatively higher retaining and sound walls in the northeastern and southwestern quadrants. As a consequence of the higher walls, this design results in greater visual impacts than Alternative 2D Variation. All other impacts are identical to those of Alternative 2D Variation. The construction cost is slightly higher relative to Alternative 2D Variation. For these reasons, this alternative was rejected.

Alternative 3A

Under this alternative, the existing four-loop interchange is retained, with some modifications to loop connectors that have heavy traffic volumes (Figure 2.3-7). These modifications include braiding the loop connectors in the northeastern and the southeastern quadrants to improve the Route 92 eastbound to I-880 northbound movements. This braiding eliminates the weaving conflicts for the Route 92 eastbound to I-880 northbound loop connector. The construction cost for this alternative is estimated to be \$34 to \$47 million (2002 dollars).

This alternative was found to be operationally infeasible due to deficiencies associated with Route 92 eastbound lanes and the weaving sections between loop connectors, as well as inadequate capacity of the loop connectors.

Alternative 3B

As with Alternative 3A, all four-loop connectors are retained. However, the weaving conflicts inherent in the existing interchange are eliminated by braiding the loop connectors after they enter I-880 (Figure 2.3-8). Other improvements include a widening of the I-880 southbound to Route 92 westbound connector to two lanes, and the reconstruction of the southern half of the Hesperian Boulevard Interchange. The construction of this alternative costs \$47 to \$62 million (2002 dollars).

While this alternative eliminates the weaving conflicts in the existing interchange, it was found to be operationally infeasible for the same reasons noted for Alternative 3A.

Alternative 4A

This alternative includes the construction of a four-lane freeway bypass, in lieu of interchange improvements (Figure 2.3-9), to divert I-880 and Route 92 traffic from entering the congested interchange. The northern section of this bypass is a four-lane freeway that begins west of the Clawiter interchange, follows the alignment of the existing Whitesell Street, bisects the Sanitary District area, and then follows Cabot Boulevard. At the end of Cabot Boulevard, the freeway heads north, then east, and connects with the Route 238/I-880 interchange. The southern section is also a four-lane freeway. It begins at the Industrial Parkway/I-880 interchange, continues along the Industrial Parkway alignment westward and then northward along Arden Road

and Eden Landing Road. The freeway meets Route 92 west of the Clawiter Interchange

(at the potential site of a future Whitesell Street/Route 92 interchange). This alternative requires a freeway-to-freeway interchange at Clawiter/Route 92, and major modifications to the Route 238/I-880 and Industrial Parkway/I-880 Interchanges. The construction cost is \$345 to \$574 million (2002 dollars).

This alternative was rejected for the following reasons: relocation impacts are greater than those that would result from other build alternatives; involves a very high right-of-way cost; has the potential of affecting wetlands in the vicinity of Arden Road; and disturbs or cuts across sites with hazardous waste contamination near Whitesell Street and Depot Road.

Alternatives 4B and 4BX

Alternative 4B also includes the construction of a bypass with northern and southern sections (Figure 2.3-10). The southern section is a four-lane, divided expressway that begins at the Industrial Parkway/I-880 interchange, and follows the existing Industrial Parkway West alignment from I-880 to Hesperian Boulevard. From that point, the expressway diverges from the Industrial Parkway alignment, continues west until parallel to Arden Road, joins the existing Eden Landing Road, then connects to the proposed Whitesell Street/Route 92 interchange. The northern section of the bypass is also a four-lane expressway. It begins at the north side of the future Whitesell Drive/Route 92 interchange, then follows the existing Whitesell Drive and a new road between the Sanitary District and the wrecking yard to Cabot Boulevard. The expressway then follows Cabot Boulevard, turns right at the end of the boulevard, and proceeds along the right-of-way line of the golf course up to West A Street. The construction cost for this alternative is estimated at \$82 million (2002 dollars).

Alternative 4B was rejected because it results in greater impacts than the proposed project without accomplishing the objectives of diverting traffic from the interchange or providing congestion relief at the interchange. An analysis of traffic operations of the new bypass with a no build alternative at the project site for the year 2015 revealed that even with the bypass, there would be only a small change in traffic demand for critical movements (ramps with congestion problems) at the I-880/Route 92 interchange. There would be neither congestion relief nor operational improvements at the interchange. The southern section of this alternative potentially

affects wetlands. In order to avoid wetland impacts, a study investigated use of the existing Arden Road alignment. However, because of existing driveways and limited right-of-way, an alignment along Arden Road is unable to accommodate the travel speeds required for this alternative. If additional right-of-way were to be acquired along Arden Road, residential and business displacements are likely.

Another bypass alternative that was examined involves a six-lane expressway with some access control along the same alignment as Alternative 4B. This Alternative 4BX was also evaluated for its effectiveness in relieving congestion at the I-880/Route 92 interchange.

Modeled traffic projections reveal that the 4BX alternative reduces the total volume of traffic approaching the interchange from Route 92 eastbound by about 900 vehicles in the PM peak hour in the year 2015, because the eastbound traffic would use the new bypass to access destinations to the north and south of the interchange. This reduction in traffic approaching the interchange from Route 92 allows a greater volume of traffic to access the I-880 northbound connector during the peak hour. As a consequence, the 4BX alternative enables 146 more vehicles to use the Route 92 eastbound to I-880 northbound loop ramp than the no build alternative. These 146 additional vehicles currently use local arterials and streets as alternate routes during the peak hour. Although this alternative improves upon traffic operations at the interchange compared to Alternative 4B, it does not completely relieve congestion, and traffic demand still exceeds the capacity of the interchange.

Lowering of Profile of the I-880/Route 92 Interchange by Either Depressing I-880 or Tunneling

These alternatives consist of reducing the overall height of the proposed new interchange to reduce its visual impacts. The lowering of profile alternative involves the construction of one of the two build Alternatives 2C Variation or 2D Variation at the project site and further depressing I-880 in the study area so that the elevation of Route 92 eastbound (the proposed highest structure at the interchange at the third level) is reduced by 3 to 6 m (10 to 20 feet).

Studies conducted when the original interchange was constructed reveal that ground water is located at approximately 1.5 m (5 feet) beneath the existing grade of I-880 at the interchange. [I-880 at the interchange is already 4.5 m (15 feet) below the original grade.]. Thus, ground water is likely to be encountered if the freeway roadbed is lowered further. To maintain the integrity of the freeway pavement under

this alternative, a dewatering system is required to pump out ground water and eliminate ground water intrusion into the pavement. This pumping would lead to lowering of the water table and possible ground subsidence in the area. Subsidence could affect residential properties near the interchange. Lowering of the grade also generates a large volume [between 229,000 and 497,700 m³ (300,000 and 650,000 cubic yards)] of excavated materials requiring disposal. Lastly, during construction of this alternative, additional right-of-way acquisition and traffic detours (possibly onto local arterials and streets) are needed, which necessitate temporary structures and retaining walls and increased costs for this alternative.

This alternative reduces visual impacts, but has potential problems of lowering the water table and ground settlement. It requires excavated material disposal, traffic diversion during construction, and additional funding. The alternative was dropped from further evaluation because the benefits of reduced visual impacts are outweighed by these other considerations.

Along the same lines as depressing I-880, a conceptual study was conducted to look at lowering the profile of the proposed I-880/Route 92 interchange through tunneling. The study was based on the existing alignment of Route 880.

The tunnel alternative consists of tunneling the Route 92 eastbound to I-880 northbound connector below existing I-880. The connector exits Route 92 to the right and enters the right side of I-880. Routes 92 eastbound and westbound are both one level above I-880. The Route 92 westbound to I-880 southbound movement would not be tunneled due to the low traffic volume in comparison to the high cost of tunneling, additional right-of-way impacts in the southwest quadrant, and additional traffic impacts. This reduces the height of the proposed interchange structure to near its present level.

This alternative affects approximately 75 to 100 residences in the northeast and southwest quadrants of the interchange. Additional impacts to right-of-way may be necessary due to the complexity of the tunnel construction and the staging of the project. In addition, the improvements to the interchange are limited. The existing weaving problems on Route 92 westbound, Route 92 eastbound, and the I-880 southbound collector-distributor road are still present.

The tunneling alternative was dropped from further evaluation because of the high number of residential displacements, severe traffic impacts, high cost of tunnel construction, and limited improvements. Other considerations included significant

maintenance requirements, mechanical ventilation for the tunnel, reduced design speed due to limited sight distance in the tunnel (this alternative requires a much lower design speed than the standard of 50 mph), and potential hazardous waste disposal costs associated with the high water table and the large volume of excavation needed.

Three-Loop Alternative

This interchange design is similar to Alternative 2D Variation in most respects except that instead of constructing the Route 92 westbound to I-880 southbound direct flyover connector, the existing loop connector is maintained (Figure 2.3-11). The deletion of the above connector results in lower visual impacts to the southwest and southeast quadrants. The construction costs are similar to Alternative 2D Variation.

Operationally, this alternative retains two short weaving sections. One is on Route 92 westbound, the other is on the I-880 southbound collector-distributor road. Both these weaving sections operate unsatisfactorily in the peak periods. In addition to the right-of-way requirements identified for Alternative 2D Variation, the three-loop alternative requires nine more residences in the northwest quadrant. This alternative was dropped from further consideration because it represents an interim project and does not improve all major traffic movements. Ultimately, another project would be required to add the omitted Route 92 westbound to I-880 southbound direct connector.

Alternative 2H

This alternative is a two-level, two-loop interchange with two flyover connectors (Figure 2.3-12). Loop connectors in the northeast and southwest quadrants are retained. The new direct connectors diverge from the Route 92 westbound and Route 92 eastbound mainlines, then branch to I-880 northbound and I-880 southbound. The three-lane (two mixed-flow and one HOV) Route 92 eastbound to I-880 northbound connector crosses over I-880 and underneath the Route 92/I-880 Separation Structure prior to entering I-880. Similarly, the one lane, Route 92 westbound to I-880 southbound connector crosses over I-880 and underneath the Route 92/I-880 Separation Structure prior to entering I-880. All exits from the Route 92 mainline and entrances to I-880 are from right-side lanes. The weaves associated with the existing full cloverleaf interchange are eliminated. The construction cost for this alternative is estimated to be \$51 million (2002 dollars).

This design was developed to address the City of Hayward's concerns, which are right-of-way impacts, the overall height of the proposed interchange, and the overall heights of combination retaining and sound walls.

This alternative was rejected for geometric and operational deficiencies. The Route 92 eastbound to I-880 northbound connector fails, or barely meets, many design standards. Consequently, safety and traffic operations are concerns given the heavy existing and projected traffic volumes for this connector. This alternative also results in a weaving distance on Route 92, between the Hesperian Boulevard on-ramp and the Route 92 eastbound to I-880 northbound connector, that is thirty-six percent less than that of Alternatives 2C and 2D Variations.

Mitigation of the safety and operational deficiencies for this alternative requires realignment of the Route 92 eastbound to I-880 northbound connector and reconstruction of the southern half of the Route 92/Hesperian Boulevard interchange. The realignment affects approximately ninety residences in addition to twelve residences at the I-880/Route 92 interchange. This concept was rejected due to the high right-of-way requirements.

Alternative 2L

This interchange design consists of a two-level, two-loop interchange (Figure 2.3-13). Loop connectors in the northeast and southwest quadrants are retained. The interchange includes a direct, flyover connector for the Route 92 eastbound to I-880 northbound traffic movement, which exits from the left side of Route 92 and enters I-880 on the right side. A second direct connector, for the Route 92 westbound to I-880 southbound traffic movement, also has a left-side exit from Route 92 and a right-side entrance to I-880. The eastbound and westbound mainline alignments for Route 92 are separated in order to maintain a two level interchange. Route 92 westbound crosses over I-880 and under the Route 92 eastbound to I-880 northbound connector before rising again to match the existing alignment. Similarly, Route 92 eastbound crosses over I-880 and under the Route 92 westbound to I-880 southbound connector, then rises to match the existing alignment. The construction cost for this alternative is estimated at \$128 million. There are additional costs associated with construction staging.

This alternative was dropped from further consideration because it fails to meet the purpose and need of the project in terms of operational and safety improvements, cost, and constructability. The proposed design of the Route 92 eastbound and westbound mainlines would result in design speeds, decision and stopping sight distances, and weaving distances on Route 92 eastbound between the Hesperian Boulevard on-ramp and the Route 92 eastbound to I-880 northbound connector that are below standards. The vertical alignment of Route 92 requires deep cuts in grade. Needed upgrading of the existing pump station facility at the southwest quadrant of the interchange and high retaining walls in the median would result in increased project costs.

The construction of this alternative is complex because traffic has to be maintained on alignments at different grade elevations, and additional right-of-way is needed just for construction. Although this alternative remains a two level interchange, the overall height increases by 24 feet above the existing interchange. Visual impacts, in comparison with Alternatives 2D and 2C Variations, decrease at the center of the interchange but increase in the northwestern and southwestern quadrants.

Transportation System Management (TSM) Alternative

This alternative involves low-cost capital improvements that maximize the efficiency of the local, existing roadway network by increasing street capacity, thereby reducing the total traffic demand at the I-880/Route 92 interchange. This may be attained by restriping shoulders and on-street parking and bike lanes to through lanes, and installing traffic signals. Figure 2.3-14 presents streets in which the number of lanes could be changed. Other TSM improvements, such as ride sharing and signal optimization, were not evaluated because ride sharing is already being implemented in the I-880 corridor, and benefits from signal optimization (in terms of reduced traffic/smooth flow of traffic at the interchange) are much less than those resulting from increasing street capacity through restriping.

A preliminary traffic analysis was conducted to evaluate the effectiveness of this alternative in reducing the congestion at the I-880/Route 92 interchange. For purposes of this analysis, the TSM alternative consisted of increasing the local roadway capacity by restriping existing roads without adding any new pavement. Traffic projections for the TSM alternative were prepared using the same traffic model that was utilized for Alternatives 2C Variation and 2D Variation. A comparison of the no build alternative to the TSM alternative revealed that even with

TSM improvements, the traffic volumes on critical movements (ramps with the maximum peak flow volumes) would be minimally changed. There would be a slight increase—about two percent—in traffic on the critical movements and the freeways in the AM peak hour, which can be attributed to increased capacities of the roadways leading to the freeways. With TSM, a slight reduction in traffic—three percent—occurs during the PM peak hour on Route 92 eastbound as traffic diverts off Route 92 at the Hesperian Boulevard and Industrial Parkway interchanges. This diversion frees capacity on Route 92 for motorists who currently avoid the route because of congestion. With this additional traffic, Route 92 continues at the route's capacity. The changes in traffic volumes are not large enough to indicate a positive impact on the I-880/Route 92 interchange operation.

The TSM alternative was therefore dropped from further evaluation because of failure to meet the purpose and need of the project. It does not provide the congestion relief required for the interchange, results in the loss of on-street parking and bike lanes, and increases traffic on city streets.

High-Occupancy Vehicle (HOV) Lane Alternative

Another alternative considered for the proposed project is the provision of an HOV lane as part of Alternatives 2C Variation and 2D Variation. Given high, AM peak hour, I-880 southbound to Route 92 westbound traffic volumes (both current and projected) and high, PM peak hour, Route 92 eastbound to I-880 northbound traffic volumes at the interchange, this alternative provides additional HOV lanes for these critical movements.

Two scenarios were considered for this alternative. The first is an HOV lane on structure (direct connector) extending between the medians of I-880 and Route 92 (Figure 2.3-15). The second is an outside/right-side HOV lane from I-880 southbound to Route 92 westbound. While operationally feasible, the first HOV scenario displaces nineteen homes (additional to those affected by Alternative 2C Variation or 2D Variation), involves the construction of another structure, and has high costs, \$28 million (2002 dollars), associated with right-of-way and construction. With the second HOV scenario, operational problems occur with median and outside HOV lanes on I-880 in the study area and weaving between the median and the exit lane. The displacement of ten additional homes is also necessary and the cost of providing the HOV lane is \$5.6 million (2002 dollars). For these reasons, the HOV alternative was rejected.

High-Occupancy Vehicle Only Alternative

This alternative is similar to the previously discussed HOV Lane Alternative in that an elevated HOV flyover connector is needed between the medians of I-880 and Route 92 to provide continuous HOV operations for the I-880 southbound to Route 92 westbound and Route 92 eastbound to I-880 northbound traffic movements. All other geometrics of the existing interchange remain unchanged (Figure 2.3-16). To accommodate this connector, the roadway on both I-880 and Route 92 would be shifted to create room in the medians. The connector ties into I-880 about 610 m (2,000 feet) north of the interchange. The connector is exclusively for HOV and transit use. The cost of construction is estimated at about \$41 million (2002 dollars).

This alternative was rejected because the existing loop connectors, which remain unchanged, do not have adequate capacity to meet future demand; sixteen homes are required and twenty-nine other residential properties; the Alameda County Maintenance Yard, and the Southgate Swim Club are adversely affected; and traffic safety could be affected by the dual movements and the left entrance on-ramp to I-880.

Furthermore, an HOV usage study estimated that approximately 400 vehicles would use the HOV direct connector in the AM and PM peak hours in year 2010. For the Route 92 eastbound to I-880 northbound movement, a detailed select link analysis projected that seventy-seven percent of the traffic would weave from the median across three lanes to exit I-880 northbound within the first four miles. Based on this analysis, providing an HOV direct connector from the median of Route 92 eastbound to the median of I-880 northbound does not improve the overall traffic operations of I-880, Route 92, and the interchange.

Transit Alternatives

The transit alternative to the proposed project consists of improvements to the existing transit services in the project area in the Route 92 corridor so as to reduce traffic at the interchange, or the construction of a transit system such as a light rail system. Planned and programmed improvements to the existing transit service in the area were taken into account while modeling and designing the proposed project.

The discussion below focuses on a new transit facility as an alternative to the proposed project.

One scenario under this alternative is a fixed guideway transit system in the Route 92 corridor. This alternative would reduce the number of cars traveling through the I-880/Route 92 interchange. An analysis of the ridership potential of the corridor was conducted (DKS 1993). For analysis purposes, the alternative assumes a high frequency, light rail transit (LRT) system between the Hayward BART station and the Hillsdale Caltrain station. The study revealed that the system increases the transit mode share for work trips, but has a daily ridership of only 8,000 persons over the no LRT scenario. A much higher ridership is needed in order to justify the cost of a typical LRT line and the structural cost of the bay crossing. In addition, the LRT reduces the number of vehicles crossing the San Mateo Bridge by about 400 in the peak hours, which is not a meaningful reduction of traffic at the I-880/Route 92 interchange. The alternative was therefore rejected because the costs were unjustified and the need for freeway, bridge and interchange improvements would still remain.

A second transit alternative scenario was recently examined. This transit alternative provides express buses in the Route 92 corridor. Again, the express buses would run between the Hayward BART Station and the Hillsdale Caltrain Station. This scenario assumed that ninety percent of commuters continue to commute alone. Of the ten percent that commute with others, half would carpool and half (five percent) would use public transit/express buses. The study assumed that the express buses accommodate fifty-five passengers and operate at eighty-five percent of their capacity. A round trip between the two locations is completed in 1.3 hours. To meet projected morning peak hour demands, twelve buses are required; to meet evening peak hour demands, twenty buses are required. The headway between buses in the morning peak hour is five minutes, and in the evening peak hour, three minutes. The operator of the express buses would have at least another seven buses in reserve and maintenance. The capital cost for twenty-seven buses, at a cost of \$400,000 per bus, is \$10,800,000 (2002 dollars). Related elements for this express buses alternative, for which no capital costs were estimated, include a bus storage and maintenance facility, park-and-ride lots in Hayward and San Mateo, and, perhaps, a fleet of vehicles for a car-sharing program at the two stations. The total capital cost for this express buses alternative could exceed \$25,000,000.

The effect of express buses on traffic operations was difficult to evaluate without assigning origins and destinations to the traffic. However, assuming the displacement of 310 vehicles by twenty express buses during the evening peak hour, the impact upon the Route 92/Clawiter Road interchange (which is west of the Mt. Eden Overhead and the Route 92/Industrial Boulevard interchange) does not appear to be of a magnitude that changes the LOS of the facility west of Clawiter Road. The express buses are just as unlikely to change the LOS of Route 92 from Clawiter Road to the I-880/Route 92 interchange. The express buses would have to wait in queues since they would be unable to bypass existing points of weaving and merging conflict. Thus, the express buses alternative fails to meet the purpose and need of the proposed project.

This evaluation of the express buses alternative relied upon conservative estimates of potential bus patronage. A more aggressive approach, with heavy marketing and multiple routes and origins/destinations, may have more of a beneficial impact upon traffic operations. The MTC and Caltrans are already working with transit operators to begin a regional express bus service based upon a Bay Crossings Study in 2002 by the MTC. This regional express bus service is a separate project that complements the I-880/Route 92 interchange project rather than replaces it.